

The Status of Tuberculosis Control in New York City

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MORBIDITY FROM TUBERCULOSIS in New York City has increased considerably over the last few years. The first significant rise in the disease was experienced in 1979. Before 1979 the number of cases reported steadily declined. The Bureau of Tuberculosis of the City of New York, Department of Health, began to verify reported cases upon the basis of bacteriological evidence of *Mycobacterium tuberculosis* in 1977. Of the 1,605 reported that year, 1,190 (74 percent) were verified as positive for *M. tuberculosis*. In 1978, 1,257 (96 percent) of 1,307 cases were positive for *M. tuberculosis*. In 1979, 1,530 cases were reported, of which 93 percent were positive. In 1980, 1,514 cases were reported, of which 93 percent were positive for *M. tuberculosis*. The preliminary figure for 1981 shows 1,550 cases of tuberculosis, of which 96 percent were verified for *M. tuberculosis*.

Other cases that were included in the tuberculosis count were added because of a biopsy result positive for tuberculosis, a positive tuberculin test, radiological evidence of the disease, or in some instances clinical evidence with a recommendation for treatment with two or more antituberculosis drugs. Nonbacteriological evidence was used, especially in assessing cases in children when a bacteriological result was negative or could not be obtained. The uniformity of the bureau's verification procedures from 1977 to 1981, the percentage of positive cases, and a laboratory surveillance program enabled the bureau to detect a trend of increasing morbidity (table 1).

A greater number of cases among the very young (manifested in more cases of miliary and meningeal tuberculosis) and a high number of reactivations contributed to the increasing morbidity. These two factors are direct indicators of the success or failure of a tuberculosis control program.

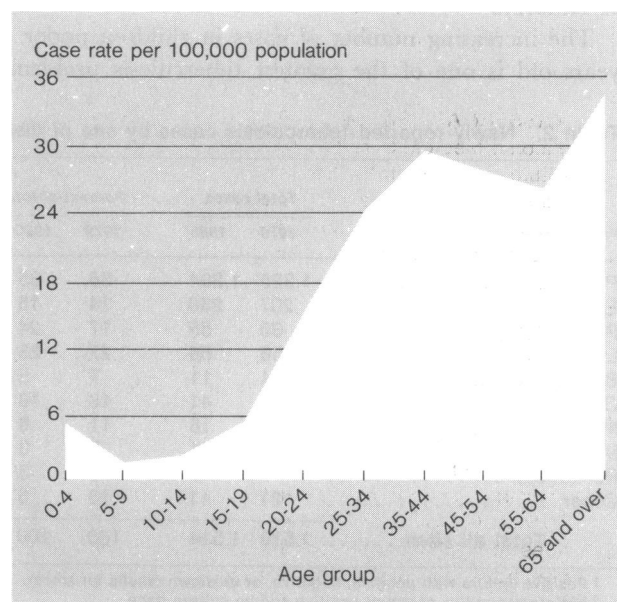
Kinds of Tuberculosis

Both pulmonary and extrapulmonary tuberculosis increased in 1979 (table 2) and remained at the same level in 1980 and 1981. In 1979, 1,450 cases were

verified as positive for *M. tuberculosis*, compared with 1,257 cases in 1978, a 15 percent increase. The ratio of pulmonary cases to extrapulmonary has remained about the same for many years. Cultures were positive for 1,258 (95 percent) of the pulmonary cases reported in 1979, 177 (16 percent) more than in 1978. The number of pulmonary cases with positive sputum cultures in 1979 was 1,234, of which 732 were smear positive for acid-fast bacilli.

The 207 extrapulmonary cases reported in 1979 comprised 14 percent of the total reported tuberculosis morbidity for that year and represented a 16 percent increase over 1978. Positive cultures were obtained in 192 (93 percent) of the 207 extrapulmonary cases reported, 42 (28 percent) more than in 1978. Compared with 1978, the increase in cases occurred at all extrapulmonary sites except the lymphatic system. Miliary cases increased from 13 in 1978 to 22 in 1979, and meningeal cases rose from 4 in 1978 to 14 in 1979. Not only the increases in miliary and meningeal tuberculosis, but also the increases in overall tuberculosis morbidity, presumably reflected an increase in the recent transmission of tubercle bacilli.

Figure 1. Case rate for newly reported tuberculosis, by age group, New York City, 1980



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Table 1. Number and rate of newly reported tuberculosis cases and of tuberculosis deaths, New York City, 1960–81

Year	Cases				Deaths			
	Number	Rate per 100,000	Percent change		Number	Rate per 100,000	Percent change	
			Number	Rate			Number	Rate
1960	4,699	60.9	...	...	810	10.4	...	...
1961	4,360	56.0	– 7.2	– 7.3	738	9.5	– 8.9	– 8.7
1962	4,437	57.0	+ 1.8	– 1.9	740	9.5	+ .3	0
1963	4,891	62.9	+10.2	+10.4	683	8.8	– 7.7	– 7.4
1964	4,207	53.7	–14.0	–14.6	581	7.4	–15.0	–15.9
1965	4,242	53.3	+ .8	– .7	592	7.4	+ 1.9	0
1966	3,663	46.6	–13.6	–14.4	537	6.7	– 9.3	– 9.5
1967	3,542	43.6	– 3.3	– 4.4	525	6.5	– 2.2	– 3.0
1968	3,224	39.7	– 9.0	– 8.9	485	6.0	– 7.6	– 7.7
1969	2,951	36.4	– 8.5	– 8.3	418	5.2	–16.0	–13.3
1970	2,590	32.8	–12.2	– 9.9	386	4.9	– 7.7	– 5.8
1971	2,572	32.6	– .7	– .6	310	3.9	–19.7	–20.4
1972	2,275	28.8	–11.5	–11.6	331	4.2	+ 6.8	+ 7.7
1973	2,101	26.6	– 7.6	– 7.6	262	3.3	–20.8	–27.3
1974	2,022	25.6	– 3.8	– 3.8	215	2.7	–17.9	–22.2
1975	2,151	27.2	+ 5.4	+ 6.3	208	2.6	– 3.3	– 3.8
1976	2,156	27.3	+ .2	+ .4	186	2.4	–10.1	– 7.7
1977	1,605	21.1	–25.6	–23.1	175	2.3	– 6.4	– 4.2
1978	1,307	17.2	–18.6	–18.5	168	2.2	– 4.0	– 4.3
1979	1,530	20.1	+17.1	+16.9	119	1.6	–29.2	–27.3
1980	1,514	19.9	– 1.0	– 1.0	135	1.8	+13.4	+12.3
1981 ¹	1,550	21.9	...	...	...	...	...	...

¹ Provisional figures based on 1980 U.S. Census figures.

Morbidity by Age Group

Although in 69 percent of the tuberculosis cases reported in the city in 1980, the patients were older than 34 years, tuberculosis was still a significant problem among children, adolescents, and young adults (table 3 and fig. 1). In 69 cases (4.6 percent), the patients were under age 15, and in 479 cases (31.9 percent), they were under age 35. These results indicate that the disease was being transmitted from older patients to children.

The increasing number of cases in children under 5 years old is one of the greatest tuberculosis problems

that the city faces. Sixteen new cases in this age group were reported in New York City in 1977, 26 in 1978, 32 in 1979, and 37 in 1980. These figures represent a greater than 100 percent increase over 5 years and a case rate of 6.3 per 100,000, compared with a national rate for this age group of 5.4 in 1978. One might assume that the cases in the children under age 5 were discovered because they were household contacts of persons with known cases of tuberculosis. Instead, most of the cases were discovered only when the children themselves exhibited tuberculosis symptoms. The cases in young children were equally dis-

Table 2. Newly reported tuberculosis cases by site of disease and by bacteriological status, New York City, 1979 and 1980

Predominant site	Total cases		Percent of total		Culture 1		Smear only 2		Negative 3		No teriological test	
	1979	1980	1979	1980	1979	1980	1979	1980	1979	1980	1979	1980
Pulmonary	1,323	1,284	86	85	1,258	1,199	29	37	23	23	13	25
Extrapulmonary	207	230	14	15	192	196	6	9	6	9	0	5
Pleural	35	55	17	24	35	43	0	8	0	4	0	0
Lymphatic	56	66	27	28	50	56	4	4	2	2	0	4
Bone and joint	14	11	7	5	12	10	2	0	0	0	0	1
Genitourinary	38	41	18	18	38	39	0	2	0	0	0	0
Miliary	22	18	11	8	19	15	1	3	2	0	0	0
Meningeal	14	21	7	9	14	17	0	1	0	3	0	0
Peritoneal	7	7	3	3	6	6	1	1	0	0	0	0
Other	21	11	10	5	18	10	1	1	2	0	0	0
Total all sites	1,530	1,514	100	100	1,450	1,395	38	57	29	32	13	30

¹ Positive culture with positive, negative, or unknown results for smear.² Histology positive or smear positive and no culture done.³ All cultures were negative.

Table 3. Newly reported tuberculosis cases by patient's age, race, and sex, New York City, 1979 and 1980

Age (years)	Total all races	White ¹		Black ²		Asian	
		Male	Female	Male	Female	Male	Female
0-4:							
1979	32	8	4	14	4	2	0
1980	37	10	7	12	7	0	0
5-9:							
1979	8	2	3	1	2	0	0
1980	14	3	1	4	4	2	0
10-14:							
1979	13	2	2	3	5	1	0
1980	18	2	2	5	8	1	0
15-19:							
1979	34	8	4	8	12	0	2
1980	42	10	5	11	12	1	3
20-24:							
1979	99	24	18	26	19	7	5
1980	96	15	13	28	28	7	5
25-34:							
1979	254	59	26	78	63	18	10
1980	272	45	29	112	60	15	11
35-44:							
1979	266	60	31	107	47	11	10
1980	244	62	25	95	45	9	8
45-54:							
1979	264	90	27	93	36	13	5
1980	231	77	26	83	33	8	4
55-64:							
1979	230	88	28	69	27	14	4
1980	216	72	37	60	32	8	7
65 and over:							
1979	330	138	80	52	35	20	5
1980	344	149	78	48	39	17	13
Total:							
1979	1,530	479	223	451	250	86	41
1980	1,514	445	223	458	268	68	52

¹ Includes white Hispanics.² Includes black Hispanics.

tributed over the city's five counties. No cluster effect was observed, and no cases were reported among refugees. Of the cases in 1980 in children under 5, 17 were in whites, 19 in blacks, and 2 in Asians (both of the Asian children had been born in this country). Because the cases in the age group under 5 years have not been adequately investigated, few of the sources of the children's infections have been identified.

The increase in tuberculosis in children is probably due to an increase in transmission of bacilli to children by parents who have tuberculosis. The existence of meningeal tuberculosis and miliary tuberculosis in children supports this view.

The 1980 tuberculosis case rate shows a decline from the 0-4-year-age group to the group 5-9 years, followed by a gradual increase to the 35-44-year group (fig. 1). The case rate curve drops once more as it approaches the 55-64-year group, and then rises sharply as it moves toward the group over age 64. The case rate curve has remained about the same over the years except for the recent rise in the 0-4-year-old group. Before 1979, the number of cases in the younger age

groups had been continuously declining, whereas the number among the older age groups was continuously increasing.

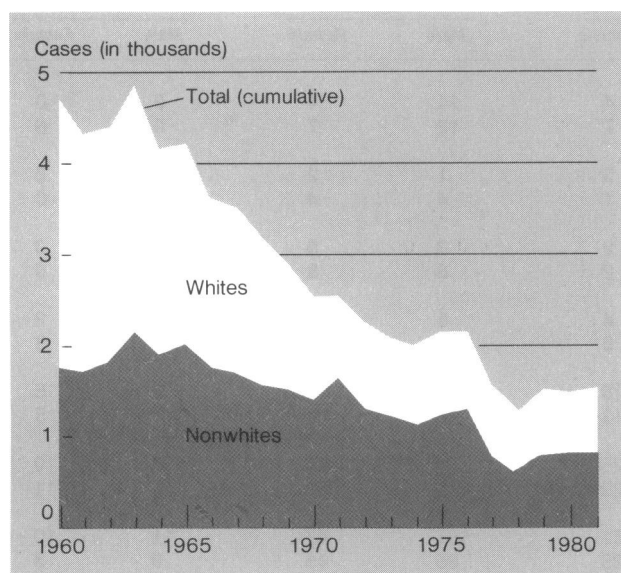
Morbidity by Race

Just as cases were reported in all age groups throughout the period 1960-80 (table 3), cases were also reported among both whites and nonwhites (fig. 2).

The most basic difference in morbidity was between whites and nonwhites. As figure 3 shows, nonwhites accounted for a greater percentage of the city's 1980 tuberculosis morbidity than whites (56 percent versus 46 percent), although they comprise only 23 percent of the population. In 1980, the corresponding percentages were 44 and 56. Whites accounted for 46 percent of the new cases in 1979, blacks for 46 percent, and Asians for 8 percent. For 1980, the corresponding percentages were 44, 48, and 8. Thus the trend of increasing tuberculosis was appearing in all racial groups.

Hispanics accounted for 32 percent of the new cases in the white group in 1979 and 35 percent in 1980.

Figure 2. Newly reported cases in whites and nonwhites, New York City, 1960-81



NOTE: 1981 figures are provisional, based on 1980 U.S. Census figures.

New cases in white Puerto Ricans increased from 40 in 1978 to 153 in 1979, decreasing to 130 in 1980.

Cases in blacks increased from 512 in 1978 to 701 in 1979 and 726 in 1980, accounting for 85 percent of all cases in nonwhites in 1979 and 86 percent in 1980. There were 18 cases in black Hispanics in 1979 and 27 in 1980. The other cases in nonwhites occurred in Asians, among whom cases rose from 61 in 1978 to 127 in 1979 and then decreased to 120 in 1980. The 1979 increase among Asians was not due to an influx of recent immigrants; only 4 cases were dis-

Figure 3. Percentage distribution of newly reported cases of tuberculosis and of population, by race, New York City, 1980

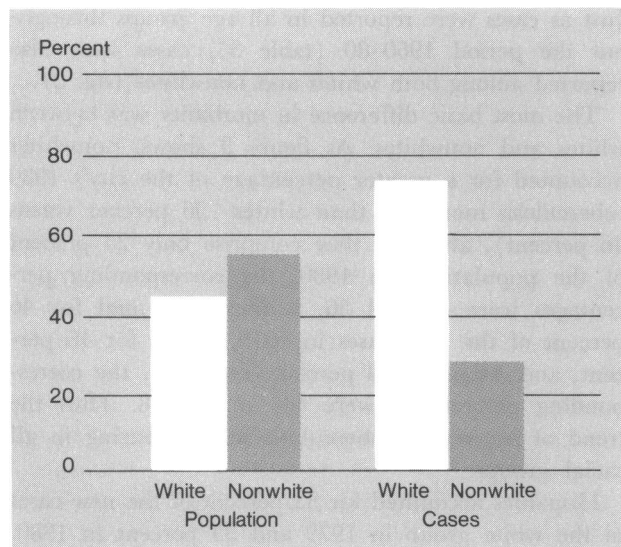


Table 4. Newly reported tuberculosis cases and rates for newly reported cases, by county, New York City, 1977-80

County, cases, and rates	1977	1978	1979	1980
New York (Manhattan):				
Cases	503	475	587	554
Rate per 100,000	34.6	32.7	40.4	38.1
Bronx:				
Cases	260	180	202	196
Rate per 100,000	18.8	13.0	14.6	14.1
Kings:				
Cases	599	405	489	500
Rate per 100,000	24.2	16.3	20.1	20.2
Queens:				
Cases	220	228	223	241
Rate per 100,000	11.1	11.6	11.2	12.3
Richmond:				
Cases	23	19	20	23
Rate per 100,000	7.0	5.8	6.1	7.0
Total (New York City):				
Cases	1,605	1,307	1,530	1,514
Rate per 100,000 ..	21.1	17.2	20.0	19.9

covered among the Indochinese refugees entering the city in 1979, as compared with 12 in 1980. Five re-activations of the disease among Asians were estimated to have occurred in 1979. (The Tuberculosis Bureau screens all newcomers and operates two clinics for this purpose.)

Morbidity by County

Each of the five counties of which New York City is composed is divided into health districts. In 1979, some residents of every health district in the city were found to have newly reported tuberculosis cases. The case rate for each health district was proportionate to its population density and reflected its socioeconomic status. In the period 1977-80, the rate of newly reported cases ranged from 6.1 per 100,000 for Richmond County to 79.0 for the Lower East Side Health District of Manhattan, as table 4 shows. Manhattan, with 587 new cases, had a case rate of 40.4 in 1979 and 38.1 in 1980. Practically all areas of Manhattan have severe tuberculosis problems, but these problems are even more serious in the Lower East Side, the Lower West Side, and the Central Harlem District—all economically depressed areas.

Mortality

In 1979, 119 persons in New York City died from tuberculosis, compared with 168 in 1978—a 29 percent decline. The tuberculosis death rate was 1.6 per 100,000 population. Twenty-nine of the cases were new ones that were only discovered at death. This figure represents a decline of 55 percent from 1978,

when there were 64 cases that were not discovered until death. Even though this decrease is significant, lack of knowledge that the 29 decedents had tuberculosis until their deaths is a cause for concern. The cases found at death (autopsy) were all in persons over the age of 30. The following table shows the sex and age group of the decedents in 1979 and 1980.

<i>Sex and age group (years)</i>	<i>1979</i>	<i>1980</i>
Total males	21	19
25-44	6	4
45-64	6	5
65 and over	9	10
Total females	8	11
25-44	5	3
45-64	1	4
65 and over	2	4
Both sexes	29	30
25-44	11	7
45-64	7	9
65 and over	11	14

Controlling the Infectious

Patients with tuberculosis can be cured provided that they remain continuously under treatment and complete their recommended course of at least two or more effective antituberculosis drugs. If such a regimen is not maintained, the patient will not be cured and may well become infectious again—or even worse—never become noninfectious. Cases reported and counted in previous years which are reactivated because the persons have not been under medical supervision for 12 or more months are defined as new cases and are verified and counted along with other cases discovered the same year. Reactivations indicate that the control program has failed to contain the disease, since the persons with the reactivated cases are also possible transmitters of the tubercle bacilli.

There were 177 persons with cases of reactivated disease in New York City in 1979 and 135 in 1980, compared with 67 in 1978. These reactivated cases accounted for 12 percent of the total 1979 tuberculosis morbidity. Ninety-three percent of the reactivated pulmonary cases and 96 percent of the total reactivated cases in 1979 were culture positive. Seventy-five percent of the total reactivated cases were in persons over age 44, 58 percent in nonwhites, and 76 percent in males.

During 1980, a total of 1,815 patients were added to the register of patients whose tuberculosis treatment was to be supervised, and 1,831 patients were discharged from supervision. In December 1980, there were 2,702 patients under supervision, 2,432 of whom were ambulatory. Of the patients discharged in 1980, 60 percent had completed their supervised treatment, 21 percent were lost to supervision, 12 percent had

died, and 7 percent had moved to another jurisdiction. Tuberculosis patients are medically supervised either by the public sector (the city health department or municipal hospital clinics) or by the private sector (voluntary hospital clinics or municipal hospital clinics). Of the 2,432 patients under supervision in December 1980, the health department supervised 17 percent, and municipal hospital clinics supervised 44 percent; the remainder were supervised by the private sector. Although clinics and physicians in the private sector diagnose and report many tuberculosis cases, in 1980 they provided medical supervision for only 39 percent of all patients with the disease.

Only 60 percent of the tuberculosis patients under supervision in 1980 were seen by a medical supervisor (medical doctor or paraprofessional) for evaluation and chemotherapy. In the period Oct. 1 1980–Dec. 31, 1980, 1,347 tuberculosis patients were lost to supervision and presumably were not on a drug treatment regimen. Such patients become candidates for reactivation of their disease and transmission of the tubercle bacilli to others; they may also develop drug resistance. Only a little over half of the 2,250 patients for whom two or more antituberculosis drugs had been recommended, had an evaluation done of their bacteriological status while they were undergoing treatment. The bacteriological status of 548 patients whose sputum culture had been positive before Oct. 1, 1980, should have been evaluated. Because they were not, the Tuberculosis Bureau was unable to determine whether the 548 were still infectious.

Tuberculosis patients on chemotherapy are evaluated in respect to the continuity of their drug treatment during the initial 12 months and in respect to their completion of the prescribed course of drug treatment. We evaluate cohorts of reported cases each quarter of the incidence year. When a high level of achievement is registered in terms of continuity and completion of treatment, the bureau is assured that infectious cases will become noninfectious and that the noninfectious cases will not become infectious. Provided that effective antituberculosis drugs have been recommended and that the patient takes them with minimal interruption to completion of the prescribed course, he or she will become noninfectious within a short period and be cured. The optimal objectives of the bureau and of the Centers for Disease Control are (a) to have at least 95 percent of the patients who are started on drugs take them without interruption for 12 consecutive months and (b) to have 90 percent of the patients complete their prescribed treatment course. The following table shows the extent to which we met these goals.

<i>Cohorts of patients</i>	<i>Percent on continuous treatment for 12 months</i>	<i>Percent who completed treatment</i>
1977		
January–March	59	49
April–June	59	66
July–September	58	52
October–December	52	64
1978		
January–March	42	45
April–June	78	61
July–September	58	46
October–December	50	56
1979		
January–March	57	63
April–June	58	...
July–September	58	...
October–December	52	...
1980		
January–March	68	...

NOTE: Leaders (...) indicate scheduled treatment period was not up.

Reasons for Treatment Failures

Analysis of our results based on the two indicators—percent on continuous treatment for 12 months and percent who completed treatment—showed that we had severe control problems. The low percentages for continuity and completion of treatment were probably due to many factors: failure to sufficiently alert the patient to the seriousness of his or her disease and the need for chemotherapy, failure to provide an effective transition for the patient from an inpatient to an outpatient treatment setting, failure to provide, as a general policy, more frequent supervision (monthly or more often) for ambulatory patients who are having difficulty complying with their treatment regimen, failure to report to the bureau when a patient breaks supervision or refuses to accept treatment, or failure to inform the bureau after such a break has occurred and a patient is lost or becomes complacent about taking his or her prescribed drugs.

Problems, conceptions, and attitudes of patients that may help account for the low continuity and completion percentages are alcohol and drug abuse and other social problems that contribute to noncompliance; assignment of a lower priority to health matters than to financial difficulties and living conditions; patients' misconceptions that they are actually in good health—a misconception that causes them to stop taking their prescribed drugs after a few weeks or months; and failure to keep clinic appointments because of frustration with the health care system.

Factors in the tuberculosis control program itself that may have contributed to the low percentages of continuous and completed treatment include inadequately trained, incompetent, unmotivated, and insufficient field staff.

The sputum cultures of patients who had a positive result when their cases were first reported are reevaluated after 3 months of supervision and treatment and again after 6 months to see if the culture has become negative. We evaluate patients with positive sputum cultures quarterly, using the same cohorts as in checking drug continuity and completion of treatment. The conversion of the sputum culture to negative is a companion performance indicator to the drug continuity indicator, in that it enables the bureau to measure its success in rendering the infectious noninfectious. Provided that effective antituberculosis drugs have been recommended and the patient has been managed so that continuity in his or her drug ingestion is maintained until completion of the regimen, in 75 percent of the cases reported with a positive sputum culture, conversion to negative can be expected within 3 months and in 65 percent, within 6 months. The following table shows our results based on these performance indicators.

<i>Cohorts of patients</i>	<i>Percentage whose positive sputum culture converted to negative</i>	
	<i>Within 3 months</i>	<i>Within 6 months</i>
1978		
January–March	30	42
April–June	33	54
July–September	32	48
October–December	34	54
1979		
January–March	32	51
April–June	35	44
July–September	41	51
October–December	41	51
1980		
January–March	26	41
April–June	28	41
July–September	22	49

The low percentages based on the performance indicator of conversion of sputum culture to negative are due to problems similar to those described in connection with the indicators for drug continuity and completion of treatment. Other factors that contributed to the substandard achievement as measured by this indicator include the supervising facilities' failure to obtain followup sputum cultures when patients are clinically and radiologically improved or when they are unable to produce sputum.

New York City's tuberculosis problem stems from reporting and financial difficulties combined with the loss of personnel that has taken place over the last years due to loss of funds for the control program. However, the total morbidity and age distribution for the disease suggest that tuberculosis is an old problem. It may well be that there is a pool of infected persons

Table 5. Identification and examination of close contacts of persons with new tuberculosis cases, New York City, 1977-79

<i>Status of contacts</i>	<i>1977</i>	<i>1978</i>	<i>1979</i>
Identified:			
Total number	2,177	1,416	1,679
Number per case	2.7	2.4	2.3
Examined:			
Total number	1,734	1,205	1,384
Percent of contacts identified ..	80.0	82.0	82.0
Not infected:			
Total number	1,117	731	923
Percent of contacts examined ..	64.5	61.0	67
Number on treatment	254	153	165
Percent of noninfected contacts on treatment	23.0	21.0	18.0
Infected:			
Total number	574	454	428
Percent of contacts examined ..	33.0	37.5	31.0
Number on treatment	492	382	371
Percent of infected contacts on treatment	86.0	84.0	87.0
Tuberculosis diagnosed:			
Number	43	20	23
Percent of total contacts	2.5	1.5	2.7

in the city who break down with tuberculosis as time goes by. If that is the case, New York City will have a continuous tuberculosis problem for many years to come. The only way to overcome it will be to strengthen our reporting and control efforts and ensure that patients complete their prescribed course of treatment.

Followup of Patients' Contacts

All persons with reported cases who are considered capable of transmitting tubercle bacilli are interviewed to elicit the names of all persons connected with them who are at risk of becoming infected. The contacts so

identified are classified as close or casual, based upon the infectiousness of the patient with the source case, the environmental factors in exposure, and the duration of the exposure.

The bureau's success in preventing infection and disease can be measured by indicators of its success in the followup of contacts. At least 95 percent of the close contacts of the patient with the source case who are identified should be examined and started on preventive chemotherapy, and 90 percent of the contacts who are put on preventive chemotherapy should complete their prescribed course of treatment. Table 5 shows the extent to which New York City achieved these goals in the period January 1977-80.

Many factors account for the low yield in contacts identified and examined, the low percentage placed on preventive treatment, and the high percentage with infection and disease. Slow reporting of cases to the Tuberculosis Bureau results in delays in the identification, examination, and preventive treatment of contacts, as well as in the bureau's inability to locate patients after they leave the hospital. Failure to explain the diagnosis or the disease process to patients results in their being uncooperative or unconcerned about their contacts. Failure to obtain the proper address of a patient at admittance greatly increases the chances that the patient will be lost to followup. Another factor in the low yield of contacts identified and examined is that patients, because of personal problems or a fear of social stigma, often refuse to be interviewed or fail to provide the names of all their contacts. The patients' desire for anonymity combined with their transiency make contacts difficult to locate. Lack of epidemiologic skill on the part of the field staff and use of poor interviewing techniques probably also contribute to the low yield in the followup of contacts.

SYNOPSIS

VENNEMA, ALJE J. (City of New York Department of Health): *The status of tuberculosis control in New York City. Public Health Reports, Vol. 97, March-April 1982, pp. 127-133.*

Problems in tuberculosis control still exist in New York City. They range from an increase in the incidence of the disease to the discovery of new cases in children under 5 years of age. Ninety-three percent (1,395) of the cases reported in 1980 were verified by cultures positive for

tuberculosis. The rest of the cases in the 1980 tuberculosis disease count were verified by histology or a physician's recommendation for treatment with two or more antituberculosis drugs.

Of the tuberculosis at extrapulmonary sites, pleural meningeal and military tuberculosis, as well as genitourinary tuberculosis, ranked high in incidence in 1980. New tuberculosis cases occurred in all age groups, but the 37 cases in the age group 0-4

years is alarming and indicates a high rate of transmission of tuberculosis from parents to children. Performance indicators of the Centers for Disease Control show that in terms of drug continuity, completion of treatment, and bacteriological conversions to negative, a great deal needs to be done in New York City.

The tuberculosis mortality rate for the city has been showing a steady decline over the years; it was 1.8 per 100,000 population in 1980.